Group 1: Developing knowledge of existing student perceptions and attributes

Use the intros on the first day to begin conversation about growth\* mindset and build off of students’ positive learning experience. \*

* Example: on first day, ask students “what is an example of something you understand well? How did you get to understand it? How do you know you understand?” And have conversation about research on brain development and about how your brain *can* learn. *Teacher attitude is very important. Cultural/academic norms significant.*

Embed the development of student attributes throughout the class.

* When students are working in groups, instructor looks for examples of productive attributes and shines a light on them.\* Not always the same people.\*
* Use CATS to share publicly student answers to open-ended questions that do *not* have “right answers” e.g. “describe this graph”.
* *Development as the capacity for self-reflection.*

Combat student perceptions that math is disconnected by emphasizing throughlines. *How does this fit with “what we know about our students”? Clarify how this relates.*

* Emphasize themes like ratio and proportional reasoning throughout the whole sequence.\*

Survey students at the beginning and at the end about their perceptions of what math is. How it is learned, and themselves as learners. \* *Of the class? Of the sequence?*

* Journaling.
* A survey at the end “I used to think…now I think…”\* *opens longer conversation. Instructors need support.*

Day 4 Group 2

Promoting Student Perceptions that foster productive engagements.\* *Very Clear*

Randomly and publicly assigned groups to foster belonging (playing cards, name card shuffling, etc.)\* *There are a variety of ways to put studets into groups. I disagree that there is any consensus that this regime is preferred. Include benefits. Communication with all types of people a big plus.What is really the significant driver here: randomness? Frequency? What makes the difference?*

\*Embedding attribute work in daily lessons, as opposed to a separate topic/class. (Pre-class study groups, quiz/test analysis and corrections, reading responses, self-assessment) *what supports an instructor’s attempt to embed these lessons if they have no prior similar experiences? Can these be course objectives?*

Public consideration of alternate/\*multiple solution methods, both correct and incorrect.\*\* (Note cards *anonymous*, showing and sharing student work, asking students to share correct/incorrect solution strategies, etc.)

Addressing Learning Skills Summary (Group 3)

**Students need to understand and own a personal rationale for why and how learning skills matter to learning mathematics.**

**Build self-reliance through embedding learning skills activities that are timely, appropriate and practical; provide ongoing opportunities (within and across classes) to practice these skills.**

***--give opportunities to reflect and share own learning successes and struggles***

***--in-class modeling of skills***

* learn how and when to take notes in inverted classroom!
* Note-taking, exam prep, review, asking questions, what to do when you get stuck
* Take notes daily—go home, re-write into 1 page, condense
* Consistency is critical
* Reflecting on exams is essential skill
* Modeling can be from teacher or from outside resource person

**This learning skills approach should be reinforced by campus resources that support students.**

* Peer tutors are great resources, don’t need to be A students
* Access to good tutor training programs
* Math anxiety workshops can be problematic
* Faculty/tutor time is key

PROMOTING SENSE MAKING AND PERSONALLY RELEVANT CONNECTIONS (Group 4)

1. Strategies that help students feel safe to explore
2. First day activities are very important

* Menu of activities include:
* List something that helps you learn and something that get in the way of learning. Think, pair, share. Post on the board to make public.
* What is something that you understand, how did you go about getting that knowledge, and how do you know you understand.
* An accessible, simple number talk

1. Students sharing work with each other
   * Leads to multiple ways of understanding
   * Increases respect for multiple approaches and individual reasoning
2. Establishing cultural norms in the classroom
   * “The perfect is the enemy of the good.” Voltaire
   * Explanation: If students shoot only for perfection they miss the opportunity for real competence.
   * Incremental improvement
   * Value mistakes as a learning step
3. Stress importance of respect (of the individual, of the learning process)
4. Field of Dreams Strategies (Physical environments outside the classroom)
   * Informal study spaces (i.e. NOT the Tutoring Center)
   * Close proximity to faculty offices
   * Promote social connections: student to student and student to faculty and informal study groups
5. Provide Multiple ways for students to demonstrate mastery/understanding
   * Formal and informal assessments
   * Low stakes and high stakes
   * Assess what we value

Day 4: Group 5

Q5 Evidence, Verification, Multiple Representation and Communication:

What are impediments?

* Math answers look like: 271.
* I don’t know the right way to explain math. Vocabulary. Notation.
* My last classroom and my textbook don’t do that…
* Mathematical practices? Multiple Representations? Evidence? What’s that?
* Math classroom is not a safe place to share my thinking.\*
* Being good at math means being quick and “right” with one-step problems.
* Math answers have a precise and formal look.
* If I know the answer in my head…aren’t I done?
* *Can teacher be an impediment? A brick? By teaching the ‘one’ way to reach a solution\*\*…This is why working collaboratively is so important\**

What can help overcome them?

* Practices are a part of assessment culture\* *structure*
* Students share needs for a safe learning environment *induction*
* Protocols for learning about evidence, communication are done on anonymous student work\* *induction.*
* Students share practices in man classes in department\* *structure*
* Introduce culture of multiple ways and valuing thinking with familiar math\* *induction; transparency about power and use of mathematical practice; How do you get at valuing multiple ways if the math is ‘familiar’? Students might already have ideas about the ‘right’ way.*
* Faculty meet, collaborate experiment\* *structure*
* Tutors know what students are doing in class *structure*